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INDEX-CONTENTS

	Page
Editorial	3
Chas. H. Proctor—Electro Deposition of Tin	4-9
O. J. Sizelove—Chrom. Investigations	10-19
B. F. Lewis—Chrom. Plate Die Castings—Read by Geo. B. Hogaboom	20-28
Branch News	29-33
A. E. S. Page	34
Branch News	35-38
Applications, Elections, Etc.	39
Directory	40

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EDITORIAL

Just twenty years ago nine or 10 congenial foreman platers, under the chairmanship of Chas. H. Proctor, had formed a modern little society for purposes of improving the art of electro-deposition of metals in all its branches and the dissemination of the knowledge of its practice.

It was decided that all laws and rules must be so formed that the society would promote no other object than that of the education of its members in the principles of electro-plating and finishing of metals and kindred materials.

It may be said that they have builded better than they ever dreamed; these thoughtful men with all their hopes and lofty aspirations could hardly have foreseen the tremendous growth of this industry; nor have anticipated the rapid rise to leadership among the educational societies of the world of the American Electro-Platers Society.

And now in the stalwart maturity of its accomplished years, when it celebrates with pride its twentieth birthday, no better suggestion can be made for its future course than that it should continue to maintain, as its chief aim, an unfaltering fidelity to those fundamental purposes which were adopted for it by its fathers twenty years ago. That way leads surely onward and upward.

THE ELECTRO DEPOSITION OF TIN

Recent Improvements in Sodium Stannate Solutions

By Charles H. Proctor

It is not the intention of the author of this paper to again go into the history of electro tin plating or its deposition by simple immersion in suitable baths or by the contact method. These data were published in detail by the author in a paper read at the Newark, N. J., meeting of the American Electro Platers' Society in June, 1926, and will also be found in The Metal Industry, December, 1926, pages 502-503. Another very excellent paper covering the same subject was also printed in the November, 1926, issue of The Metal Industry, page 463, entitled "Electro Deposition of Tin" (Practical methods of tin plating), by Walter Fraine. These two papers cover in detail the sodium stannate tin solution first introduced to the metal fabricating industry by the author.

In the past few years the electro deposition of tin in the metal fabricating industries has grown to be of great importance primarily because tin is nature's best gift to mankind to coat steel with for protection and conservation of his food products, almost indefinitely, as pure as when they came from nature's gardens.

The saving in cost to the consumer in food products so conserved runs into hundreds of millions of dollars per year.

Electro tin deposits, however, are not as yet applied to the thin sheets of steel which eventually become the "tin plate of commerce." All tin plate is produced by the application of molten tin to the sheet steel by immersing the cleansed and previously fluxed sheet steel in the molten tin bath with subsequent quenching in the proper cooling medium which results in the bright tin plate of commerce. Hundreds of thousands of tons of such product is produced in America today.

In the non-ferrous metal industry, however, the electro deposition of tin, especially in the production of tinned sheet copper and brass, has not assumed great tonnage production. The hot tin application is still used extensively for the purpose, for the coating of sheet copper with tin for heavy coatings especially adapted for the fabrication of copper steam kettles used in the dairy, vegetable and fruit preserving and candy making industries, electro deposited tin upon copper, and finally rolled under

the usual metal rolling process to produce hardness and render the crystalline structure of the deposited tin, less crystalline and more compact due to a slight elongation of both the tin and copper resulting from the metal rolling process is constantly on the increase.

One of the largest copper and sheet brass and incidental products industry in America, if not in the world, is using the electro tin plated process for sheet copper as outlined.

The value of tin as we all know from the hundreds of millions of tin cans used in the cooking and preservation of all kinds of food products is because tin is not acted upon by lactic acid or any of the fruit and vegetable acids that nature has placed in our food products for the good of humanity.

In the electric refrigeration industry electro tin plated deposits upon copper refrigerating coils, etc., is being used very extensively. One of the largest of such firms in the middle west operates a complete tin plating unit for this purpose. It is completely automatic in every detail from the cleansing of the copper coils, etc.; the coppering over of the soldered joints, etc., by copper plating, the several water washings, the final tin plating, washing and drying of the product, so that it eventually is placed by mechanical conveyors in front of the inspector to be finally passed along for assembly and finished product.

The tin plating bath alone has a volume capacity of 20,000 gallons. In addition many mechanical plating barrels are operated in the same plant for tin plating small metal parts used in the construction of the refrigerating units.

In your great and wonderful magic city of Chicago electro tin plating has been done for more than fifteen years. Quite recently a very progressive firm of mechanical platers for the jobbing trade installed electro tin plating baths from data submitted to them by the author, and their business is constantly growing for electro tin plated products.

In the telephone industry, electro tin plating will no doubt be used extensively for the protection of brass and copper fabricated parts from atmospheric oxidation. One of the largest of such firms has adopted the method after extensive research by their engineering department.

In the manufacture of all types of meters, whether electrical, gas or water, electro tin deposits have been found to be the best

protecting factor against oxidation for all the small gear parts, pinions, etc., used in the construction of such meters. Especially so is this true for meters used in tropical countries where high humidity atmospheric conditions exist.

Cadmium deposits were first tried out but due to galvanic action between the brass metal and the cadmium deposit, the cadmium disintegrated and returned to a semi-oxide condition and became entirely non-adhesive, so its value for protecting brass from atmospheric oxidation is practically valueless.

It is possible to continue the elaboration of the value of electro tin deposits further, but it is not necessary for the purpose the author has in mind, that of giving data covering the improvements in the present tin electrolytes. There is, however, one important factor that I should mention to you considering the tremendous increase in cost of cadmium metal during the latter months of 1928 which will eventually destroy all interest in the metal from its economic value as a maximum factor in the protection of ferrous metals, iron and steel, from atmospheric corrosion and eventual destruction and be replaced with deposits of zinc from improved methods of deposition and the introduction of the rust proof black finishes.

The metal fabricating industry is anxious to learn the true reason for such a tremendous increase in the cost of the metal. Is it due to manipulation or to the natural law of supply and demand? This is what the electro plating industry has a natural right to know as well as the metal fabricating industries.

The electro deposition of cadmium can be replaced as a protecting anti-corrosion factor by deposits of zinc at one-twentieth the cost of cadmium, when the cost of the metal at one dollar and twenty cents per pound is used as a basis as against ten cents per pound for electrolytic zinc. Furthermore, we must also consider that the density of cadmium is 75 per cent greater than zinc, when we reduce density to cost figures, then we find a cubic square inch of cadmium will weigh 75 per cent more than an equal cubic square inch of zinc. You can see then that if you deposit one-ten-thousandth of an inch in thickness of either cadmium or zinc upon a basic metal surface the cadmium will be 75 per cent heavier than the zinc in weight. Therefore, in figuring costs of cadmium plating as compared with zinc upon its true basis you will arrive at a cost of twenty to one as compared with

the same thickness of zinc deposit at a cost of ten to fourteen cents for zinc anodes.

It is always well to remember that you cannot deposit any metal at a lower cost than that of the price of the anode irrespective of any contention or controversy to the contrary.

When you have decided to replace cadmium with zinc then install an improved electro tin plating solution, if you decide that you want a finish equal in whiteness to that of cadmium. Only a very minute deposit of electro tin will be necessary upon the basic deposit of zinc then you will have produced a duo deposit of zinc and tin that may give you even a greater protective value than it is possible to obtain from either zinc or cadmium alone, at one-tenth the cost of cadmium. The tin will prevent the zinc from atmospheric oxidation, therefore, a more perfect protection against atmospheric corrosion should result.

In the R. & H. Chemical Company's research division at Perth Amboy, N. J., we are making comparative tests as to the economic and protecting value of the duo deposits of zinc and tin as against zinc or cadmium as separate protecting factors. Metallic tin costs only one-half the price of cadmium.

I have elaborated in detail because I desired to bring the true story of electro deposits of tin to you. In my December, 1926 paper covering the "Electro Deposition of Tin" the following formula was given:

Water	1 gallon
Sodium stannate (Na_2SnO_3)	28 ounces
Hydrated tin oxide	2 ounces
Powdered white starch	⅛ ounce

The latter material as the brightening agent for the tin deposit.

Potassium resinate was also given as a colloidal factor for the production of whiter and brighter deposits of tin. The temperature of the bath 160 to 180 degrees Fahr. Voltage, 4 to 6. Anodes, pure Straits of Malacca tin in connection with anodes of sheet steel—70 per cent of the anode surface to be of tin and 30 per cent, sheet steel. Stannous chloride ($SnCl_2H_2O$) was also mentioned as an excellent reducing agent.

Mr. Walter Fraine in his excellent paper presented at the convention of the American Electro Platers' Society, June-July, 1926, gives almost identical data for electro tin plating with a sodium stannate solution.

Later some modifications in the original solutions as introduced by the author were made. Lower density solutions gave just as good results, hydrated tin oxide additions were eliminated, also the starch as a brightening agent. Stannous chloride and the potassium resinate were still found to be satisfactory as addition agents.

The R. & H. Chemical Company still believed in the future of electro tin plating and considerable research work has been done during the past year to improve present existing sodium stannate solutions. Solutions of the acid or semi-acid type do not give the throwing power which is an essential and necessary factor for any type of metal articles having deep depressions plated with tin.

Improved Tin Plating Solutions

Water	1 gallon
Sodium stannate	12 ounces
Sodium acetate	2 ounces
Sodium hydroxide	1 ounce
Sodium perborate	⅛ to ¼ ounce

Temperature, 160-175 degrees Fahr. E. M. F., 4 to 6 volts. Cathode current density, 20 to 60 amperes. Anodes, pure Straits tin. Ratio, 3 to 1 anode cathode.

Preparation of Solution

Dissolve the sodium stannate in about 50 per cent of the total amount of water at 150 degrees Fahr., then add the caustic soda, sodium acetate and finally sodium perborate. Steel tanks are advisable for electro tin plating solution, heated with iron steam coils.

The solution is quite easy to control but whenever possible chemical analysis is preferable. This is true for all plating solution. Know the composition of your solutions, then make additions accordingly. Only upon such a basis can you develop "Standard Solutions" and their control on an economic basis.

Maintain the density of the tin solution as an approximation at 10 degrees Baume. The addition of sodium stannate to maintain this density will depend upon actual amount of metal products produced from the tank or tanks, and the loss in drag out. It may require a minimum of one ounce per gallon of solution or several times the amount. When the caustic content of the solution is correct the tin anodes cover over with a very thin

yellowish green film during electrolysis. Absence of this film and very white anodes denotes an excess of caustic soda. The excess can be reduced by the addition of glacial acetic acid in small quantities until the anode coating is normal. The addition of acetic acid and its neutralizing action upon the caustic soda forms sodium acetate which is an essential factor of the solution. If, at any time, the caustic soda content becomes too low for successful anode corrosion and throwing power then additions of ⅛ to ¼ ounce per gallon of solution should be made but should not be exceeded until the results have been determined by trial tests.

The addition of sodium perborate should be made when the tin deposit no longer shows the semi-lustre white color. One-fifteenth ounce or less will be ample per gallon of solution. The sodium perborate is apparently more active when first dissolved in warm water, then very slightly acidulated with acetic acid, so that a very light pink tone is discernible when a blue litmus paper test is made.

In mechanical barrel plating the density of the solution may be increased up to the following proportions:

Water	1 gallon
Sodium stannate	16 ounces
Sodium hydroxide	4 ounces
Sodium acetate	4 ounces
Sodium perborate	¼ ounce

Anode to cathode ration, 1 to 1 to 2 to 1. Amperage, 10 to 15 per square foot of surface area. Electro motive force, 6 to 8 volts. Temperature, 140 to 160 degrees Fahr. Speed of rotation of barrel, 10 per minute, plus or minus. The control of the barrel or mechanical solutions is identical with still plating solutions.

It has been found that the still solution formula gives excellent results also in a barrel, so it can be left to the plater or chemist to decide just what proportions for solution is best adapted for his purpose, from the minimum to maximum formula outlined.

All commercial metals and alloys may be plated with electro deposits of tin from these solutions. Cast iron, steel, copper, bronze, brass, zinc, lead, zinc die castings and cadmium. The necessary cleansing must be carried out under commercial conditions best adapted for the respective metals to be tin plated. As all platers as a rule thoroughly understand the preparation of the

basic metal surfaces and their chemical cleansing it is not necessary to go into the matter in detail at this time.

If better results are obtained in electro tin plating from the data included in the paper and a greater demand for electro tin plated products results, I shall feel fully repaid for the time spent in writing up this paper.

PAPER ON "CHROMIUM EXPERIMENTS"

By Oliver J. Sizelove, Newark Branch

MR. OLIVER J. SIZELOVE: In presenting this paper I would like to just say a few things before proceeding, that chromium was suggested as a study by members of the Newark Branch in the class that was taught last winter at the Vocational School at Newark. The solution or formula taken was the Bureau of Standards' formula that was used in all our experiments and it was simply a repetition of the work that has been done by the Bureau of Standards by the plater or common plater. I will say, of today. Those experiments were practically duplicated, showing you that it doesn't require a man with a great knowledge of chemistry to produce those same results.

"The students, foreman electro-platers, of the Electro-plating class at Sussex Avenue Vocational School, Newark, New Jersey, requested that a study be made of chromium plating solutions. The class was divided into small groups, each group under the leadership of a plater, who possessed a fair knowledge of the chemical control of plating solutions in general. The whole class was under the direction of the instructor.

"The plan of study included the making of a chromium solution according to a workable published formula, and the effect of different variables on the operation of the solution and the character of the work produced. The Haring formula, as published in the U. S. Bureau of Standards Technologic paper No. 346, was used. The variables included temperature, area of anode and cathode surface and their relation to each other, metal for anodes, metal for cathodes, current density, concentration of chromic acid and of sulphuric acid and cathode efficiency. The 'tanks' used were made of steel and had a capacity of two gallons. With few exceptions made for experimental data, the cathodes were rolled brass which had been colored buffed. Anodes of steel, of stainless steel, and of lead, were used. In

all runs the area of the anode was one-half of that of the cathode, except in one run where the effect of the area of the electrodes was studied. Two anodes and one cathode were used. The cathode area was sixteen sq. in., 1/9 sq. ft. or 1 dem.^{2}, the distance between electrodes four inches.

"*Effect of Temperature.*—Having an anode area of one-half the cathode area and keeping a constant current density, 1.25 amperes per sq. inch, the effect of varying temperatures is quite noticeable. At 90° F. the polish brass cathode assumes a dull milky color with cloudy edges. At 113° F. the center of the cathode is clear and bright, but the edges are still cloudy. At 131° F. the entire surface is clear and bright. It is evident that at this temperature and current density the best results are obtained on polished brass cathodes in the Haring solution containing the recommended amount of chromic acid and sulphuric acid.

"*Current Density.*—Using the same solution at the temperature at which the best results were obtained an experiment was made to ascertain the effect of different current densities. At .8 amperes per square inch the deposit is clear and bright. At 1.9 amperes per sq. inch the edges of the cathodes become dull. At 3.5 amperes per square inch the whole surface of the cathode has a dense matted appearance, the edges showing a distinct burnt appearance. It is quite evident from these experiments that the current density of 1.25 amperes per sq. inch is probably the proper one to use at this temperature.

"Another set of cathodes were run at a temperature of 113° F. for comparison. At .5 amperes per sq. inch the deposit is clear and bright. This is what would be expected as both temperature and current density have been decreased. At 1.25 amperes per sq. inch the edges of the cathode become quite dark. The same frosted appearance of the cathode is had, as in the previous test, where a high current density is used. For example, 2.5 amperes per sq. inch.

"*Anode Area.*—There has been considerable discussion as to the relation of the anode area to that of the cathode area. When the anode area is one-half that of the cathode area in the recommended Haring bath at 1.25 amperes per sq. inch and 113° F. the surface of the cathode is clear and bright. If the anode area is increased so as to equal that of the cathode, the edges and

especially the bottom have a distinct burnt appearance. If the anode area is increased fifty per cent over the cathode area the burnt edges present a different appearance. It seemingly gives a hard brittle deposit. This is what would be expected in an ordinary plating solution except that in the latter case there may be granulations.

"When the anode area is equal to the cathode area there seems to be a difference in the current distribution which effects all sides of the cathode, while with the large anode area the effect seems to be at the bottom of the cathode. This is what would be expected when the anode area is larger than the cathode area. It is of interest to note that at the same current density the voltage is lower when the cathode area exceeds the anode area.

"*Anode Material.*—When different anode material is used in a solution at a cathode current density of 1.25 amperes per sq. inch a marked difference is seen in the deposit on the cathode. This is quite unexpected and of interest. It should also be noted that to obtain the current density given that different voltages were necessary.

"With lead as the anode 5¼ volts were used and the cathode while bright in the center had milky edges. When steel anodes were used at a pressure of 4½ volts, the same current density was obtained as above and the cathode was clear and bright. Stainless steel contains chromium and as would be expected it offered more resistance to the current and therefore 4¾ volts were necessary to obtain the same current density. The cathode had patches that are dull while main body has a bright lustre but not as brilliant as when steel or lead was used.

"*Cathode Material.*—It is quite important that the factors governing the conditions for good deposits be carefully controlled when cathodes of different metals are used. In the experiments made the anode was in all cases half of that of the cathode. The temperature was constant, 113° F. If brass is used as the cathode, it is evident that the current density range for a bright deposit is quite wide as very similar deposits were obtained at .65 and 1.25 amperes per sq. inch. In both cases, the pressure was 4¼ volts. In using steel as the cathode the same general conditions are noted except that at the higher current density the deposit is more clear and has a more dense appearance.

"When lead is used as the cathode the effect of current density

is readily seen. While this may be true in the same way with other metals, it is not as effective as with lead. At a current density of 1.25 amperes per sq. inch the lead cathode has a complete covering of chromium and at .65 amperes per sq. inch the lead is only stained. This indicates that at low current densities there is no reduction of chromium at the cathode made of lead.

"Method of Introducing Cathode in Solution.—There is a difference of opinion as to whether the work should be in circuit before being introduced into the solution or if the current should be turned on after the work is in the solution. In the samples shown the word 'alive' indicates that the current was on when the cathode was plated, and the word 'dead' indicates that the current was off when the cathode was put into the solution.

"On steel there is seemingly very little difference, probably some evidence of a slight stain. With brass as the cathode the deposit is more brilliant when plated 'alive.' When 'dead' the deposit is milky.

"It has been stated that chromium can be deposited upon a chromium plated article if the cathode is dead. The experiment made indicates that either 'dead' or 'alive' the deposit is not to be compared with that obtained directly upon a brass or steel surface. It is evident, however, that there is less tendency for the deposit to peel or raise when the cathode is 'dead.'

"Chromic Acid.—While a standard solution made of thirty-three ounces of chromic acid, .33 ounces suplhuric acid to one gallon of water is generally recommended, in the series of experiments conducted, the effect of a lower and also of a higher concentration was made. This had an effect upon the efficiency and upon the character of the deposit which was expected.

"In plating in general it has always been considered that a fairly high metal concentration will give the best cathode efficiency. Recent experiments seem to indicate that this is not entirely correct.

"In the chromium solution that had practically one-half the concentration of the solution generally used a cathode efficiency of 18.9 per cent was obtained, while a solution having twice the concentration had an efficiency of only 8.3 per cent. This is in direct contrast with the efficiency of the standard solution which was 16.3 per cent. The solution was run at 1.25 amperes per square inch and at 113° F. The anodes were of lead and the

cathodes brass. The anode area was one-half of the cathode area. This may be seemingly contradictory, but it should be borne in mind that the deposit was upon a flat surface. It does not follow that the dilute solution is the ideal one as other factors, such as throwing power, may be affected to such an extent that it would be impracticable to use commercially. It does, however, make an interesting experiment and produces results that should be of value for certain classes of work.

"*Sulphates.*—The sulphate content of a chromium solution exerts a greater influence upon the deposit than is generally supposed. In all probability the failure of a great number of solutions has been due to an incorrect sulphate content. If it is too low or too high, poor results are obtained. It affects distribution of the current, character of the deposit and throwing power.

"From a series of experiments made, there seems to be little difference as to what kind of a sulphate salt used. The greatest effect was noted in the amount used.

"In a solution containing no sulphates the efficiency is zero. Nothing but a discoloration of the cathode is obtained. At the concentration recommended by Haring, a higher cathode efficiency is obtained than with twice the amount of sulphates added. The throwing power and adherence is best in low sulphuric acid concentration.

"Experiments were made with solutions containing thirty-three ounces chromic acid, .24 ounces, .48 ounces, .72 ounces, and .96 ounces of sulphuric acid per gallon. The effect of each concentration of the sulphates is noticeable. It would be difficult to put this entirely in writing and it is suggested that a study be made of the samples.

"In this experiment some of the cathodes were bent at right angles and used to ascertain the throwing power. It is of interest to note that the solution containing a low sulphate content (.24 ounces) has the best throwing power.

"In solutions having 66 ounces chromic acid and 1.35 ounces sulphuric acid per gallon, the throwing power is poorest and contrary to expectations the character of the deposit on a flat surface from the same solution is excellent.

"In general it has been found that the proportion of 100 parts by weight of chromic acid to one part by weight of sulphuric acid gives the most consistent results, thus confirming Haring's conclusions.

"Experiments made with this solution show the efficiency to be from 4.1 per cent to 5.5 per cent. If these efficiencies are compared with those of the dilute solution previously mentioned in this paper it will be noted that there is quite a difference. The average efficiency of the more concentrated solutions is 4.7 per cent, while that of the low concentrated solutions is 14.8 per cent.

"To test the throwing power of the Haring solution, experiments were made with cathodes bent at right angles using a total current upon a surface of eight sq. inches at ten, six and four amperes. The best throwing power was had at the highest current density.

"The author wishes to thank the students of his class for their careful work and the assembling of the data which is incorporated in this paper, also Dr. Graham for his valuable suggestions." (Applause.)

Mr. Musick took the Chair during the reading of the above paper.

CHAIRMAN MUSICK: Are there any questions to be asked of Mr. Sizelove?

QUESTION: In working on the anode surface was any attempt made to make the relative position of the anode to cathode the same as where the larger anode surface was used?

MR. SIZELOVE: Yes, the current density was maintained the same.

QUESTION: But the physical relation between anode and cathode—(interrupted).

MR. SIZELOVE: No, only with the exception that when we studied sulphate factor in those anodes that were bent at right angles, some of them in that case, the lower part of the cathode, would have been nearer to the anode than the top of it.

QUESTION: How long was it run?

MR. SIZELOVE: Five minutes.

QUESTION: Was an investigation made as to the formation of chromates?

MR. SIZELOVE: There were samples taken from the solution. Complete analysis has not been made of that, when it is it will be published. There is other work to be done upon it, and as the work is completed it will be published.

QUESTION: I understood you to say you used a steel anode.

When you used steel, did you use half of the cathode, the same as the lead? (Assent.) What were the results of that?

MR. SIZELOVE: When steel anodes were used the efficiency seemed to be higher but I don't think it is advisable to use the steel anode. That is the reason I realize the experiments when checked up didn't give the results we could recommend in using the steel anode. Products form on the steel anode which do not on the other anode.

MR. WOOD: I would like to make a few remarks on the lead anode question as applied to chromic acid plating bath. Probably the only reason we use lead anodes for anode material or use lead for anode material is because we keep the solution oxidized, thereby minimizing the injurious effect of trivalent chromium. If the lead anode is placed in the solution and worked very quickly there forms a layer of lead peroxide. The lead peroxide which has the immediate effect of keeping the solution oxidized, not the lead itself, lead peroxide, if you once form a coating of lead peroxide you find even in standing over a considerable period of time there is practically no tendency for the formation of lead chromate, and you don't have to clean your anode if you have lead peroxide on it. Lead chromate is injurious, and if it forms on the anode, remove it, by all means clean them. If you take an anode out, clean it, use it for an hour, you will again have a coating of lead peroxide on the surface, and also there does not seem to be a very great tendency for that lead peroxide coating to increase in thickness. Therefore, increase resistance receptivity, and so cause trouble on that score. I think at times it might be to your advantage to remove anodes from the tank and keep them clean, but my experience has been a very infrequent cleaning is all that is necessary.

QUESTION: I want to ask how to prevent lead chromate from forming on the lead anode.

MEMBER: In the operation of the bath, oxygen is liberated at the anode in some way, the same as in a storage battery, and the tendency under electrolysis is for the lead peroxide to form and not for lead chromate to form.

If lead stands exposed, the fresh surface of lead in the chromic acid plating bath lead chromate forms rapidly and in considerable thickness. It is entirely due to the electrolysis of the solution.

MEMBER: Between loads you have got to let your anodes stand in chromic acid bath, electro chromate forms.

MEMBER: It has not been my experience that it forms in any considerable amount. This lead peroxide usually forms a fairly adherent coating on the lead, and therefore protects any lead from the action of the chromic acid bath. The chromic acid bath is in itself an oxidizing solution and its tendency seems to be to maintain the coating of lead peroxide once it is completely formed in preference to taking the lead underneath and forming lead chromate.

MEMBER: That is the opposite experience.

MR. SEEBURGER: There is a difference in quality of lead. by using lead with a six per cent antimony you do not get lead chromate formed like you do with pure lead.

MEMBER: I surely neglected to mention that. I stand corrected. It is very important in the use of an alloy lead anode.

MR. ALLEN: The first two or three weeks I thought we had to clean those anodes. I don't know anything about chemistry or anything like that but I want to tell you that for eight months or better they have never been out of the tank and we are getting good results, so you can put that down from practical experience.

MR. Ter DOEST: I would like to say that when I take my anodes out I am in trouble. As long as I leave them in there I do nice work but my anodes are so constructed that I have to change the anodes for different work I do, and when I take them out I get into trouble. When I leave them, I don't. I have it thick in one hour. It is just as smooth as it can possibly be.

DR. GRAHAM: I would like to refer to the last gentleman's remarks. I believe it can be possible that he can have his positions so fixed that he gets satisfactory results after leaving his anodes in the tank. We can plate with anodes which are badly polarized by formation of a film of lead chromate, but the gentleman that formerly spoke about that said he used about seven and a half volts. I believe if you refer to that, if your have pure leads, clean lead, as your anode, you can accomplish your deposition at a lower voltage than that. If you take your anode out it is likely that the condition under which your deposit to get your satisfactory result will be different and will take some experimenting to determine just exactly what positions of voltages will

give you a correct result, but I still believe that the clean anode will give you a better result.

Mr. Wood referred to the effect of lead peroxide on that anode. I believe that the tendency for the lead chromate to form when the anode is allowed to remain in the solution without current would be reduced. I don't believe it would be eliminated. On the other hand, in putting that peroxide coating on the anode, if the practice of merely hitting your lead anode in the solution and turning current on is going to be used, there is a question of how effective a film of lead peroxide you are going to form. You know in making storage batteries the method of producing that peroxide film is the most important thing, and they go to a great deal of care and trouble to get a thick, impervious peroxide coating. I believe that just hiding your anode in the chromium solution that would be the case in ordinary operation, the peroxide which forms there would not be a very thick impervious coating, and it is still possible that the lead chromate would have an effect.

Then going back to another point: it has been proven that pure lead will regenerate your chromate salt and acid more effectively. Now, there is a question as to whether you think it pays you to use anodes which are polarized with chromate, use a high voltage to get your results, and build up chromium salt in your solution, or to remove your anodes daily, keep them fresh and clean, by so doing, plating at lower voltage and maintain your chromic content of your solution more nearly constant. It is up to you to determine which pays you, but there are both sides of the picture.

MR. Ter DOEST: In view of Mr. Graham's saying about the voltage, the voltage I used, the maximum, three and a half; on different work, it is from three to three and a half according to the job I do, but I have had more trouble with anode corrosion than any one thing I have had to do with and I found out when I left them alone I was all right. I had them in hydrofluoric acid and potash and I don't know what, all night too, and couldn't get it off, and that is in the solution and kept there.

MR. HOGABOOM: When one speaks about the voltage that is used in chromium solution it is probably essential that you should designate the relation between your anode and your cathode area.

MR. Ter DOEST: Three anodes and one cathode.

MR. HOGABOOM: That is why you have a low voltage. It is very easy. Suppose you have one square foot of anodes and one square foot of cathodes and you are running, we will just take a problematical solution, 100 amperes to the square foot. At that relation you are using, we will say, six volts. You have then accumulated current density of 100 amperes. You have an anode current density of 100 amperes. If we change this and make it one-half a square foot anode, one square foot of cathode, and we want to get 100 ampere cathode current density, then we must have 200 amperes anode current density and we cannot get that at six volts. It is quite probable that we may have to go to seven and a half volts. On the other hand if we have one square foot of anode and half a square foot of cathode and we want 100 amperes per square foot on the cathode we can get that at fifty amperes anode current density and instead of six volts we may get that at three and a half volts, so when I am talking chromium solution and talking on what voltage you are using you must take into consideration the relation of your anode to your cathode area. (Applause.)

MR. GRUND: I might say I take and plate a twelve foot square area with an anode surface of eight and a half sq. feet. The anode we use is of an air hoist type. The anode is taken out of the tank and hoisted by air at the end of the day's run. We just merely rinse that off with a hose and brush and let it hang there over night, and that is all that is done, and we have had no trouble. The thickness of the anode is about three-sixteenths of an inch in thickness.

MR. HOGABOOM: I would like to ask one question, please, of Mr. Wood. In the case of where the anode may have a peroxide, is there not a tendency for lead chromate to form that is not adherent and falls to the bottom of the tank.

MR. WOOD: I don't believe we could use lead anodes in an acid chromium solution without getting some lead chromate formed, but it is never formed in our experience in very large amounts. I don't know why it is so we plate successfully without cleaning anode and with low voltages, keeping in mind the fact that we use relatively large anode-cathode area ratios but we do not have much trouble with formation of lead chromate on six per cent antimony lead anode.

MR. Ter DOEST: This anode question—I think the higher

current concentration at the anode, the less trouble you will have. They will say, why don't you make your anode surface smaller. I can't. I am within a quarter of an inch of my anode now. I am putting each one of these in a hole to take the concentricity. We sent these out to have done by all kinds of people, plated on two sides, but not on the other two. With the federal indicator it jumps like that, and to get these round we have a hole in the anode we drop each one in, that is three-quarters of an inch. The article is about a quarter of an inch and we are a quarter of an inch round and we cannot make the anode surface smaller, but it is my experience before that I think the higher current density at the anode the less trouble you have with the anode.

PAPER ON CHROMIUM PLATING DIE CAST METAL

By Mr. B. F. Lewis, of Detroit

PRESIDENT FEELEY: I have asked Mr. Hogaboom if he will read this paper as Mr. Lewis is not present.

MR. HOGABOOM: The announced subject of this paper might be construed as indicating that the chromium plating of die cast products is fundamentally different from the chromium plating of other metal products. Let it be understood, however, that such is not the case; on the contrary, most of the observations here set down apply equally to all products which are plated with chromium over nickel.

It has been aptly stated that the plating of chromium over nickel is a certain test of the adhesive quality of the nickel deposit, from which it follows that to produce a successful chromium finish upon a nickel plated die casting we must be assured of a nickel deposit which is free from internal stresses and sufficiently thick to resist the tendency to peel under the influence of the chromium plating process. To this end several factors should be under control.

While these may seem obvious, any one of them, if overlooked, may be the cause of the failure of the finish; first, cleaning. Since it is common practice to clean zinc base die castings electrolytically by making the work the cathode in alkaline cleaning solutions the composition of these cleaners should be such that there will be no tendency to deposit upon the work any zinc, copper, etc., which is usually present in cleaning solutions which

have been in use on zinc-alloy castings. Metals so deposited in the electro-cleaning may cause peeling of the nickel deposit in the chromium plating operation.

Second: rinsing. It is well known that cleaning solutions of various compositions vary in respect to the ease with which they may be rinsed from the work. To be assured of complete and thorough rinsing it is usually advisable to pass the work through a neutralizing dip to convert any alkali adhering to the work to salts which may be readily rinsed off. For this purpose a dilute acid may be used, e. g., a three per cent solution of muriatic acid in water. Third: nickel plating. In the nickel plating operation, the factors which influence the adhesive quality of the deposit, presuming the work to be chemically clean, are the composition, temperature, and relative acidity of the solution. The composition of nickel solutions suitable for zinc die castings is more or less limited to the citrate type and the high sulphate type, in either of which considerable latitude as to actual proportions of the constituent salts is allowable. More important, perhaps, is the matter of impurities. Of these, iron is usually the most conspicuous and troublesome. Fortunately, it may be rather easily removed by oxidizing with hydrogen peroxide, or potassium permanganate, and precipitating with ammonia as basic iron compounds, which may be removed by either filtering or decanting and subsequently readjusting the Ph.

It is very desirable to keep the solution as nearly free from dissolved iron as possible in the interest of a malleable, adhesive deposit; as to temperature, it is very desirable to keep this as high as compatible with reasonable throwing power, as temperatures lower than 70° F. are conducive to hard, brittle deposits, susceptible to cracking and chipping when chromium plated. The acidity most favorable to a nickel deposit suitable for chromium plating is approximately Ph 6.0.

By maintaining careful control of the factors which have been noted failures in chromium plating on zinc alloy die castings due to defective nickel may be minimized, if not eliminated.

In the chromium plating process a satisfactory deposit depends almost equally upon the mechanical and chemical phases of the process. Chemically, the solution should conform quite closely to the formula:

CrO_3—32 oz./gal.
$Cr_2(SO_4)_3$—.4 oz./gal.

On small installations the sulphate content is found to remain quite constant if the dragout is not excessive, and if evaporation is replaced with tap water, which usually contains some sulphates. Commercial chromic acid also contains sufficient sulphate in most cases to maintain the proper ratio of sulphate to chromic acid. It is necessary, however, to check the sulphate content by analysis at frequent intervals to insure against trouble from variations in this constituent. The actual chromic acid content is subject to rapid decline under operating conditions, due to its reduction to chromium dichromate, and must be frequently replenished. The hydrometer test is of little value in determining the chromic acid content in solutions which have been operated for any considerable time. When chemical control is not readily available, a deficiency of chromic acid is usually indicated by the appearance on the work of spots which receive no deposit, at points which receive relatively high current density. In old solutions containing an accumulation of chromium dichromate, this spotting will occur frequently unless the chromic acid and sulphate content is maintained at the prescribed concentration.

The mechanical features of chromium plating involve first of all the control of the temperature of the solution. While it is possible to control the temperature manually, the advantages of automatic control make it almost indispensable to production plating. Under the heads of mechanical factors should also be mentioned the method of racking the work. The same principles govern as in nickel plating. Small parts may be grouped upon the rack in such a manner as to shade each other at points where burning might be expected.

The difficulty of covering the edges of holes may be overcome by plugging with suitable stoppers. Since this difficulty is apparently caused by excessive agitation due to the concentration of currents of free hydrogen at these points, it seems logical to make use of this effect by suspending the part to be plated in such a position that thin edges and other projections which receive the greatest relative current density will also be in the line of hydrogen currents rising from other parts of the work. These currents of gas, by agitating the solution at the desired point, serve the purpose of reducing the tendency to burning at such points. As an illustration of this, consider the plating of a part having the shape of a disc with thin edges. If the piece is suspended with its flat surface vertical and parallel to the anodes the lower edge

will almost certainly be burned at the voltage necessary to cover the whole surface, while the deposit at the top edge will be very thin.

If, however, the piece is suspended with the flat surface horizontal and below the anodes, a relatively high current may be applied without burning the edges, since all of the hydrogen liberated on the lower surface of the disc must rise around the edge and set up agitation at that point which will effectively prevent burning.

The notoriously poor throwing power of chromic acid solutions is frequently made even worse by certain conditions in the nickel coating. This is particularly true of brass parts which have been barrel nickeled, and the recessed parts of tank plated die castings which receive a comparatively thin deposit of nickel. Whether the difficulty of covering these surfaces with chromium is due to a film of oxide upon the nickel or to the presence of other metals in the nickel deposit has not yet been determined. It has been found, however, that in the case of die castings whose very irregular shape made nickel plating difficult and chromium plating nearly impossible, the difficulty may be overcome by immersing the nickel plated part in a dilute solution of sulphuric and nitric acid containing some copper sulphate, and rinsing thoroughly just before plating with chromium. In this way parts having fairly deep recesses may be completely covered with chromium at relatively low current densities.

Another factor which seems to have considerable influence on throwing power is the cleaning of the work. The usual procedure of simply wiping the color-buffed nickeled surface before chromium plating serves very well on simple shapes but on the more intricate shapes further precautions seem desirable. The most effective, as well as the most simple, expedient, is to take the parts from the nickel coloring operation and suspend them at once in the chromium plating solution, applying just enough current to cause slight evolution of hydrogen for a short time, e. g., thirty seconds. This serves to remove the light film of grease from the work. The current density may then be increased as much as is necessary to completely cover the work. This procedure serves to increase the apparent throwing power as work treated in this way may be plated at a considerably higher current

density without burning than is possible without the application of the low initial cleaning current.

This covers the subject of Chromium Plating Die Cast Products as far as the limited observations of the writer permit. While it is obvious that the statements herein are not supported by scientific explanations, it is hoped that they will stimulate discussion which will be of value to the plating profession. (Applause.)

PRESIDENT FEELEY: As the author of the paper is not here——(interrupted)

MR. HOGABOOM: I would like to discuss that paper.

MR. HAY: I want to ask Mr. Hogaboom if it is possible to chromium plate die casting successfully in order to stand up against atmospheric corrosion.

MR. HOGABOOM: No, and yes. You can plate die castings so as to have a complete covering of nickel so that there will be no porosity. Such die castings according to some good authorities have proven to be poor withstanding actual corrosion. There seems to be an effect of the metal so that there will be blistering. If, however, a light coating of nickel is placed on a die casting so that there is some porosity, then whatever occurs in the die casting comes out in the porosity and you can wipe it off and the nickel does not peel.

MR. HAY: I would like to ask you another question, Mr. Hogaboom. Does the temperature have any effect on the corrosion of die castings? The temperature of conditions or atmosphere.

MR. HOGABOOM: Yes, just the same as—wasn't there an illustration on the board the other night, or a photograph of Mr. Liscomb's where temperature of a nickel plated soft metal was increased. I believe the work was done in Hanlon's plant, and you got a sweating out where there was tin in the die casting through the pores of the metal. Evidently that has been done. Now, about die castings, I believe that a great deal of the trouble, not all of it, has been due to a point that has not been brought up, to my knowledge, at any electro-chemical or electro-plating meeting.

Dr. ———, who is professor of metallurgy at Yale, who is consulting metallurgist for the New Jersey Zinc Company, and probably one of the best authorities on zinc in this country, has

found that very slight impurities of certain materials in die cast metal, poisons the die casting and that these have a material effect upon not only the life of the die casting itself but on the finishing and the subsequent deposit. Such a paper, I believe, was presented a little over a year ago at the Institute of Metals. I have promised myself several times to go down and see Dr. Mathewson (?), with whom I have a pleasant acquaintance, and obtain the paper and see if it could not be presented so the platers could have access to it.

It is well known in the electro-deposition of zinc and refining that small percentages of impurities, for example one hundredth of one per cent of cobalt in a solution used for electrolytic recovery of zinc will prevent deposition entirely. So there may be impurities, or, he has proven at least that there are impurities in die castings that will act as the beginning of the diseases that will grow during the life of the die casting.

MR. HAY: I want to ask another question. With the proper Ph of sixty with die casting, that is I mean nickel plate before you chrome plate, taking into consideration you would clean the die casting properly under ordinary conditions, would you believe you would get any peeling?

MR. HOGABOOM: The Ph may be changed. If the die casting was not clean on account of the material that has gone in the solution, I think the cleaning is essential. Dr. Hiram Lukins in a recent paper before the Electro-Chemical at Bridgeport showed conclusively that poisons not clean did not permit the complete reduction of chromic acid from (?). There was a medium point there in which there was a creation of chromium trioxide. That built up the chromium bichromate in the solution which was very detrimental and in commercial work he has found that work that has not been cleaned, that solution is in which work is put that have not been cleaned, can be plated, that those solutions build up very rapidly in chromium bichromate and therefore destroy their efficiency.

I would like to speak just one moment, I know the time is short, on Mr. Lewis' paper. He states that if he is plating work in a special plating barrel or work that has deep recesses, and he puts it in chromium solutions he is apt to get a peeling in the recess and wonders whether that is due to a film of oxygen or what it may be due to. I am wondering whether it may not be due to

the porosity of nickel, the barrel plated work is porous, the work that is plated light in deep recesses is porous. It is getting electro-chemical action there. As soon as he puts that in a copper sulphate solution, which he says he does, he gets a precipitation of copper. That precipitation of copper covers the base metal. As Graham told you, chromium will deposit on copper surfaces more readily than upon any other surface. It seems to me the trouble with which Mr. Lewis is confronted is porosity of deposits.

DR. BLUM: At various times during the discussion of chromium plating it has been emphasized one of the greatest values it has had to electro-platers is to make them improve their nickel plating, and this is a good illustration of that and a very good illustration. It shows it is possible for Mr. Lewis and others to regulate conditions in nickel plating to get any desired results.

Now, it so happens that in nickel plating die castings in either of the solutions to which he referred, with either high sulphate, you have high polarization, that is why you put the citrate or sodium sulphate in there, to retard the tendency of the zinc to deposit nickel by emersion, but by that same fact as Mr. Graham also pointed out, you tend to make harder and brittler dips which therefore are more likely to crack.

Therefore, it is a question of compromise. In other words, Mr. Lewis uses the citrate or the high sulphate and then in order to get his deposit a little softer he runs up the Ph a little bit and the temperature as high as he can and still get a satisfactory deposit. A very good illustration. I would add this on to Mr. Van Dereau's talk, plating engineering, simply controlling conditions. Don't say you get this kind of a deposit, and therefore it is no good. If you get too hard you can make it soft, if too soft you can make it harder, so that is why I believe chromium plating is going to be one of the finest things for improving nickel plating also. (Applause.)

SECRETARY GEHLING: There arises a question in that plating die castings there that will be brought up at most of the branches during the coming year probably, that a whole lot of the men have overlooked. That man Lewis is running into part of it. The one thing that impresses me is how he keeps plating die castings in barrels if he has a lot of them and isn't black nickel plating them.

It is a difficult thing to plate die castings in a barrel, if they are small or large. You can plate one or two batches or ten batches, but keep plating all the time and you are going to find out you are up against a tree. The question is being asked in Philadelphia Branch at the present moment. I will read the question so as to give you an idea of what we are driving at. "How can excess zinc be removed from a nickel solution?" This excess zinc is dissolved in the nickel solution while plating die castings that cannot and do not have to be plated in deep recesses.

Every one of you fellows have seen automobile locks and they are all die castings. The manufacturers of those plugs and locks do not want the die castings plated inside because that interferes with the tumbler. There would be no sense in having castings made in dies if they had to match them and check them up. When you plate 25,000 to 50,000 of those a day in a solution no matter how small the particle is that will be dissolved, even if you keep the Ph of your nickel between five eight and six you are going to get some of that zinc in the nickel solution, and after you plate a while you can imagine that getting from a hard brittle deposit you would get from adding zinc to a nickel solution. Some of our members have added that as a brightener almost to the point of fact the amount of zinc they get in there is what you would put in if you were going to make up a black nickel solution. You may say, stop off these parts in there; the stop off varnishes are as hard to get off as the plating from the recesses. They have a predicament there.

Now, it seems funny in the remarks in the paper about chromium plating on the die castings on the nickel surface and having a porosity. Personally I plate quite a few thousand a day of those same lock parts after nickel in chromium and they lay around and slide around and get thrown around and there is no damage done to them. We don't have much trouble chromium plating on the nickel plating and it doesn't spot through or break through.

One of the convictions I myself have, the same as the other two members of our branch, is in keeping the zinc that dissolves off the die castings in the nickel, keeping it out, otherwise we have to make up nickel solutions and throw them away after using them a certain length of time. No matter what you say

at the front they think you don't know how to fix your nickel solutions, they can't see the part that is taking place, that doesn't interest them. The only thing that interests them is the fact that you are throwing away a solution. I think that question will become a debatable matter during the coming year. I don't like to go into further detail. I would like to see Mr. Lewis' solutions if he plates much barrel work in a nickel solution, in about three months' time if he has any sort of production, to see how he keeps it down. Sodium sulphate or citrate does not keep the zinc out of the solution.

MR. HAY: I would like to know the suggestion of Mr. Gehling. When it comes to drawing away a solution contaminated with zinc I would like to suggest he use it for a brightener in a nickel solution.

SECRETARY GEHLING: How much do you think I put in? (Laughter.)

MR. HAY: It may sound comical but it isn't. I think everybody knows that an excess amount of zinc in the solution would cause ——? and it happens that in this case, speaking of myself, I am not ashamed to say I got by using 500 gallon solution, adding that to a 4,000 gallon solution, wonderful results contaminated with zinc.

SECRETARY GEHLING: That may be all right, we will admit that. I explained that to start. People put zinc in as a brightener but you also put in with a larger quantity you make a black nickel solution. I have just been informed by one of the members here that through Mr. Lewis we are confused in the respect that he did not barrel plate this nickel, that it is done in a conveyor tank. That relieves my mind because I thought I was way off on the barrel business.

MR. NAGEL: In reference to getting rid of the excess zinc, I have used a solution for six or seven years, didn't throw any of it away. You run the Ph. up to seven, caustic soda, precipitate most of the zinc, adjust your nickel with salts and adjust the Ph and it is just like a new solution.

MR. HOGABOOM: If Mr. Nagel would use calcium carbonate he wouldn't get precipitation in the nickel.

CHICAGO BRANCH

Regular monthly meeting of Chicago Branch was held Saturday, April 13, at Atlantic Hotel.

Meeting was called to order by President Robt. Meyers, presiding. The attendance was very good, it being one of those old fashion educational meetings and every one carried home new thoughts, as everybody took part in the discussions.

The report made by Mr. F. J. Hanlon, from the East, was great. We all appreciate it when Frank makes a report, as it is so thorough and so well covered that everyone gets the full benefit of his report.

The Convention Booster Committee held their first meeting Saturday and reported progress, expecting a big surprise by next meeting in their report, something that everyone will make all of us want to go to Detroit.

The May meeting will be great as that is the night when most all members of Chicago Branch, within reasonable distance, come to elect the officers for the new year, and there are some hard fought battles to try to get the best men in the Branch for the various offices, but when the election is over everyone forgets the election, gets behind the newly elected officers and work for the benefit of the Branch. If you want to see something good, come to Chicago Branch meeting, May 11th.

Mr. Vernon W. Wells, representative of the Carborundum Co., gave a lecture, and also showed motion pictures of the manufacturing and the different uses of carborundum, which were very interesting as well as educational. Mr. Wells also gave some very interesting information on glue and the best way to use it.

The regular order of business being completed the Librarian found the following questions in the question box:

Ques. 1. What is a good oil to preserve extruded bronze and keep it from tarnishing?

Ans. 1. No answer given.

Ques. 2. Is an excess of peroxide harmful in cold nickel solution? Are perborates in it harmful?

Ans. 2. No. As hydrochloric acid is added it has a tendency to throw out the perborate.

Ques. 3. Will sodium perborate acidulated with hydrochloric acid increase the chloride in a nickel solution?

Ans. 3. It will increase chloride according to amount of acid used.

Ques. 4. Wanted a black on nickel silver, must be a dip oxidize, as have no current to plate.

Ans. 4. Arsenic in muriatic acid used warm.

Ques. 5. Must the lead anodes be taken out of chromium solution over night or any time when solution is idle, that is, if no plating is done in solution?

Ans. 5. Best to remove anodes. To clean, use saturated salt solution acidified with muriatic acid.

Ques. 6. Would like to know what white acid is, and how it is made; it is used for frosting glass.

Ans. 6. Hydrofluoric acid.

Ques. 7. How to prepare and plate chromium on white metal door handles.

Ans. 7. Plate in solution composed of single Nic salts, 21 oz.; sodium sulphate, 24 oz.; sodium chloride, 2 oz.; boric acid, 3 oz.

Ques. 8. If the Ph. of nickel solution is 6.2 and muriatic acid is added, will the Ph. be raised or lowered?

Ans. 8. Lowered.

It is with deep regret that we learn of the death of Raymond Servis, the son of O. E. Servis, Past National President and Secretary and present Librarian of Chicago Branch, A. E. S. We herewith extend to his parents and wife and family, our deepest sympathy in their bereavement, and may God comfort them.

There being no further business, meeting adjourned at 10:45 P. M.

S. J. C. Trapp, Sec'y.

ROCHESTER BRANCH

Rochester Branch held their 17th annual banquet and educational session at Powers Hotel, Saturday, April 13th.

President Reama opened the educational session by welcoming all the members and friends of Rochester Branch. He then introduced Mr. Frank Kolb, Chief Chemist of Bausch & Lomb Optical Co., whose talk was very interesting, and he concluded his talk by asking all eligible persons present to join the American Electro-Platers' Society.

Mr. George B. Hogaboom was next on the program and his famous question box was then introduced; to say it was the best talk on plating in general is only giving Mr. Hogaboom a small amount of the credit due him.

Rochester Branch wishes to give Mr. Hogaboom a vote of thanks for his coming to Rochester, and they hope he will be with us again.

The question box is the most interesting way there is to bring out plating problems.

Mr. Ernest R. Beightol of Buffalo, N. Y., then spoke a few words, urging the Buffalo men to get busy in their city.

After the meeting the ladies joined with the men and the largest banquet in the history of Rochester Branch was on. The entertainment was very good and special mention is made of the tap dancing of Dorothy Schutt and Ruth Yockel. After the dinner dancing was enjoyed by all to the music of Joe Stark's Melody Boys, assisted by Mr. S. P. Gartland, who called the old fashioned square dances. The committee wishes to thank all who helped put this banquet over and hopes next year it will be larger than this year.

The banquet committee was Chas. Griffin, S. P. Gartland, Raymond Lopoz, Clarence Reama, Eli Beaudry, John W. Snyder and Wm. Hart.

Chas. Griffin, Sec'y.

1928-1929

NATIONAL COMMITTEE LIST

Research—Chairman, R. J. O'Connor, Bridgeport Br.; Treasurer, Phil Sievering, Newark Br.; J. E. Sterling, New York Br.; W. S. Barrows, Toronto Br.; S. E. Hedden, Pittsburgh Br.; W. Jordan, Hart.-Con. Valley Br.; Ex-officio, Dr. Wm. Blum, Balti.-Wash. Br.

Prize Award Papers—Chairman, O. J. Sizelove, Newark Br.; George B. Hogaboom, Newark Br.; S. P. Gartland, Rochester Br.; H. Ter Doest, Cleveland Br.; Dr. A. K. Graham, Philadelphia Br.; Dr. Wm. Blum, Balti.-Wash. Br.; Ex-officio, F. J. Hanlon (Editor), Chicago Br.

Past Presidents to Assist Secretary-Treasurer on Constitution—W. Fraine, Dayton Br.; Geo. B. Hogaboom, Newark Br.; H. H. Williams, St. Louis Br.

Special Committee to Get Data on Nickel Solutions—Geo. B. Hogaboom, Newark Br.; O. J. Sizelove, Newark Br.

In Memoriam

Philadelphia Branch

Honorary Member
E. F. SMITH

DIED MAY 3, 1928

WORCESTER BRANCH

A meeting of the Worcester Branch of the American Electro-Platers' Society was held Thursday, March 21, at the Chamber of Commerce Building.

It was proposed that plans be made for a meeting to be held in Gardner on May 4 and it was agreed to ask Mr. Anderson to arrange this meeting.

Mr. A. N. Garrepy was appointed Chairman of the Nominating Committee, with power to choose two assistants.

There being no further business, a moving picture entitled, "The Age of Speed," as prepared by the Norton Company, was shown.

R. H. Bryant, Secretary.

NEWARK BRANCH

The regular monthly meeting was held April 5, Friday evening, at Franklin Hall. The speaker of the evening was Dr. A. K. Graham, of Phila. Branch, and Penn. University. Subject was "Corrosion Protection," and illustrated his remarks on blackboard, and same was a fine insight to this subject. At conclusion of lecture Dr. Graham was given a rising vote of thanks by all present.

National President Smith, with entire Ex-Board and Research Committee, were in attendance as were Messrs. Proctor, founder of Society; and both Research members of our fellowship at Bureau of Standards, Messers. Barrows and Farber, and past presidents, Hogaboom, Fraine, Mesle, Uhl, Sterling, and many visitors from New York Branch, including President Mac Stocker, such celebrities as Capt. Floyd Taylor, Van Winkle Todd, Harry Flanigan, Thos. Haddow and others your correspondent did not know, were present. Newark Branch members were there in a body to welcome the gathering and it was a meeting long to be remembered.

National President Smith introduced the many visitors and welcomed them on behalf of Newark Branch, and Newark Branch and Chemistry Class members then presented Mr. O. J. Sizelove a token of their esteem and love for many sacrifices he had made endeavoring to explain the mysteries of the mechanics of analysis of plating baths and it sure was a surprise to Oliver and much pleasure to the boys.

President Smith then stated that as soon as the meeting adjourned there would be refreshments served and informal visiting until midnight.

SPRING RESEARCH MEETING

The meeting was held at Newark, April 6th. The morning session opened at 9 o'clock with O. J. Sizelove presiding, who in his business-like manner, proceeded to introduce Mr. C. A. Barrows, of Research Fellowship of A. E. S., at Bureau of Standards, Washington, D. C., who proceeded to inform the gathering that complete investigation of research on spotting out would soon be available, as it was being proof read at Government Printing Shop now, and then gave resume of last six months' work in gathering and compiling data which was very interesting.

Dr. Blum, the unimitable, gave general outline of researches, at Bureau, also some explanatory remarks on Mr. Barrows' and Mr. Farber's work and his talk brought home the vast amount of good the Bureau and there fellowships are doing for their respective industries.

Mr. Farber, research associate in Bureau Fellowship of A. E. S., gave a very interesting discourse with use of charts on Throwing Power in Chromium Solutions, all of which was very well illustrated and will soon be in print that we may all get copies.

Dr. Blum also gave a talk of H. R. Moore's paper on Conductivity of Chrome Solutions, which was interesting and well received.

M. R. Thompson, of Bureau of Standards, spoke on Analysis of Cyanide Solutions and the thought of Ph. Scale for Potassium and Sodium Cyanide Solutions, and showed instrument that was used, all of which was very interesting to those present.

There were 175 males, one lady present at the morning session, and interest was high, the meeting adjourning at 12:30 noon.

The afternoon session convened at 1:30 o'clock, with Chairman R. J. O'Connor of Research Committee, member of Bridgeport Branch, presiding. He immediately stated reason of meeting and introduced Dr. Blum, who gave an outline of investigation on Ph. Measurement of Nickel Solutions, as conducted by Messrs. N. Bekkdahl, of Bureau of Standards; K. Pitschner, American Chemical Co.; C. J. Rosencrans, Leeds & Northrup, A. K. Graham of University of Penn., and J. T. Burt-Gerrans, of University of Toronto, Can. He stated that methods used were hydrogen electrode, quin hydrode, and colormethic, and that results obtained showed a variance of results and a difference of approximately .5 between lowest and highest results and it was believed that if platers giving solutions, Ph. for comparison would state the method used, a factor could be found that would make it possible to know just how to balance investigations, although different methods were used.

Mr. R. O. Hull, of Electrotypers Fellowship at Bureau of Standards, gave a nice talk on the additional agents of Copper Electrotyping Solutions.

As C. T. Thomas, of Bureau of Engraving, was absent, Dr. Blum read his paper on the Iron Deposition, which was very interesting, and Dr. Blum explained it very thoroughly.

Having just an hour left the Chairman thought it would be a good plan to hold open forum on value of our research, and ask suggestions from subscribers to research fund in attendance, also the A. E. S. members in the session, and it was thought that to continue study of Protection of Corosion Values of Nic, Chrome, Tin and Cad. should be continued by majority and if Research Committee reaches the manufacturers in near future for a continuance of this research investigation for another three year period and are successful, above suggestions will be followed out, and if not, our present funds will only allow us to continue until December 1, 1929. It is hoped by all attendants of this meeting that auto industry will assist more liberally on this investigation as it is a vital one to entire industry and especially them.

A. E. S. PAGE

Assembled Expert Scraps With and Without Significance

"Hurrah" for President Smith and his favorite song, "Pneumonia." T. Slattery, Baltimore - Washington Branch, sure can sing it. Hot.

Chas. Barbour of Bridgeport Branch sure is game to take a chance hauling the Chairman of Research Committee and Editor of Review into Connecticut on a Sunday.

Phil Sievering may be an old member of Newark Branch "but he is just a kid when it comes to entertaining.

Mr. McCord of the Detroit Branch is an interesting attendant at our research meetings.

Dr. Blum sure was there with a fund of information and some 100 dollar words.

Dr. A. K. Graham is sure getting some fine dope for the boys, and his illustrations are very good.

Meeting Lucky Gehling had a little hoarse.

Saw Bill Stratton of Bridgport Branch there, even if customers do kick after Bill gets six bucks.

J. E. Sterling, Tom Trombour, Harry Flanigan, Tom Haddow seemed to enjoy Newark with O. J. Sizelove.

Chas. Proctor, W. Fraine, Geo. B. Hogaboom, Capt. Taylor and Bill Maas all seemed to be in good spirits.

Van Winkle Todd and Bill Ward seemed to be apple knockers and peach boosters.

The Bureau associates seem to be getting into better voice.

Ye gods, the women are better each year. How they can yump the rope.

Newark can sure be proud. Best yet.

Philip Uhl said so.

MILWAUKEE BRANCH

Annual meeting held April 6th at Schroder Hotel; educational meeting, with Pat Sheehan acting as chairman, was well attended of discussion of live character.

The annual banquet and dinner was attended by some 200 people and was a very fine affair. There were 30 of Chicago Branch members and guests present.

Dan Wittig.

CHARTER MEMBERSHIP LIST OF MEMBERS OF THE LOS ANGELES, CALIF., BRANCH

Charles A. Russell, 1232 S. Grand Ave.....Los Angeles, Calif.
Ernest W. Francis, 1843 W. 79th St.....Los Angeles, Calif.
Henry A. Brannon, 109 E. 31st St.....Los Angeles, Calif.
Benj. Foss, 118 W. 36th St.....Los Angeles, Calif.
Louis M. Blaisdell, 787 E. 15th St.....Los Angeles, Calif.
E. P. Robinson, 6551 W. Blvd. .....Los Angeles, Calif.
Philip M. Virtue, 1650 Long Beach Ave.....Los Angeles, Calif.
James H. Weaver, 900 E. Pico St.....Los Angeles, Calif.
Earl Coffin, 2910 S. San Pedro St.....Los Angeles, Calif.
Ray Vasques, 2910 S. San Pedro St.....Los Angeles, Calif.
O. S. Pendlay, 3447 E. 25th St.....Los Angeles, Calif.
M. D. Rynkofs, 1350 W. 25th St.....Los Angeles, Calif.
George W. Kyle, 2034 Bay St. .....Los Angeles, Calif.
Martin H. Brooks, 515 W. Washington St.....Los Angeles, Calif.
B. C. Gardes, 360 S. Los Angeles St.....Los Angeles, Calif.
Chas. S. Howe, 1300 S. Los Angeles St.....Los Angeles, Calif.
Eugene D. Bedwell, 109 E. 31st St.....Los Angeles, Calif.
Don. M. Bedwell, 109 E. 31st St.....Los Angeles, Calif.
J. R. Delaney, 1633 S. Los Angeles St.....Los Angeles, Calif.
M. McNulty, 631 S. San Pedro St.....Los Angeles, Calif.
J. A. Kirso, 4961 E. 50th St.....Los Angeles, Calif.
E. D. Martin, 2810 S. Main St.....Los Angeles, Calif.
Frank C. Rushton, 1127½ LaVeta Ter. .....Los Angeles, Calif.
Joseph Ellis, 421 W. 58th St. .....Los Angeles, Calif.
Robert Gibson, 2945 E. 4th St.....Los Angeles, Calif.
Joseph Corbit, 203 N. Ave., 57.....Los Angeles, Calif.
John L. Marigold, 425 E. 92nd St.....Los Angeles, Calif.
C. E. Thornton, 11756 Welby Way.....North Hollywood, Calif.
Robert U. Gripp, 650 Rose Ave.....Venice, Calif.
E. A. Savery, 2964 American Ave.....Long Beach, Calif.
Harold E. Coombes, 28 W. Union St.....Pasadena, Calif.

M. S. Rynkofs, Secretary.

Branch Secretaries, Take Notice

Several of these members are now being transferred from St. Louis, Toronto, Pittsburgh, Newark and Chicago Branches.

Editor.

LOS ANGELES BRANCH (TEMPORARY)

A meeting of the temporary Los Angeles Branch was held Wednesday, April 10, at the Y. M. C. A. Twenty-nine sat down to dinner, after which temporary President Clarence Thornton, called the meeting to order. After business had been disposed of, the meeting was turned over to Charles Russell for educational discussions, Cleaning of Metals being the chief subject. P. A. Boeck, of the Oakley Chemical company, gave a very comprehensive talk on the cleaning of metals, explaining the action of cleaners in still and electric cleaners and effect of direct and reverse current.

The value of the copper cleaner strike was emphasized after several present had told of cleaning difficulties overcome by its use.

The meeting, following the receiving of a permanent charter from the Supreme Society, will be an open smoker meeting, and all who are interested in the art of Electro Plating will be invited. This will be a sort of booster meeting and should give L. A. Branch a good start.

M. D. Rynkofs, Secretary and Treasurer.

PITTSBURGH BRANCH

Our April meeting took on the form of a banquet, and was in honor of Dr. William Blum, Chief Chemist, Bureau of Standards, Washington, D. C. Our dinner party attracted many noted men from the American Chemical Society, American Electro-Chemical Society, and the University of Pittsburgh; this fact made it one of the most outstanding electro-chemical meetings ever held in our city.

President Herman Peter, in his address of welcome, introduced Mr. Erwin Sohn, who acted as toastmaster. Mr. Sohn proved to be a past master and managed to bring out the good points of every active member. Mr. Sohn in turn introduced our speaker, Dr. Blum, who gave a summary of the results of research at the Bureau of Standards during the past year. He touched upon every phase of the research, and brought out many interesting points, after each subject, the discussion only proved that the work being done at the bureau is being appreciated. We had plenty of discussion, but owing to the fact that many of the men present were going on to Newark, N. J., to attend the Research Committee meeting called for Saturday morning, we had to break up early to allow them to catch the train. It is hoped that our Branch will have an early opportunity of having other such interesting meetings, for when we say that we had upwards of 80 men interested enough to attend a meeting of this nature, electro-plating, will be benefited by them.

S. E. Hedden, Sec'y-Treas.

TORONTO BRANCH

The Toronto Branch held its regular monthly meeting on March 25th, at 22 College St., President J. Walker presiding.

After concluding the usual business, Mr. Jas. Cairns, a member of our Branch, favored us with an interesting paper, "Nickel Plating on Steel." He also showed samples of same, which were creditable.

The balance of the evening was spent in testing samples of nickel solutions taken to the meeting. At a later date we hope to have complete reports from the members regarding their tests.

A point of interest emphasized was that nickel solutions with a greater anode area than cathode area solutions, were inclined to run alkaline.

W. J. Sutherland, Sec'y-Treas.

BALTIMORE-WASHINGTON BRANCH

Our regular monthly meeting was held March 16, in the Association of Commerce building, 22 Light St., Baltimore, Md., President F. F. Pierdon, presiding. As a special attraction we had a five-reel film, entitled "Jewels of Industry," by the Carborundum Co. of Philadelphia, shown and explained to us by Mr. Wells. The film showed us how carborundum wheels are made and the different methods of using them. And as the film was being shown Mr. Wells explained the several important processes of manufacture these wheels had to go through before they are ready for use, and the several different trades where carborundum are used, as an essential factor in the present demand for production.

We had about 150 members and friends with us and a very enjoyable evening was spent.

A standing vote of thanks was given Mr. Wells at the close of his interesting lecture.

Next meeting to be held April 13, in the Enoch Pratt Library, Calhoun and Hollins Sts., Baltimore, Md. All members are requested to attend.

George P. Turner, Sec'y.

PROVIDENCE-ATTLEBORO BRANCH

Providence-Attleboro Branch is steadily making progress along the line of higher efficiency; a number of our members are attending Dr. Strachan's "Class for Electro-platers" at Brown University.

We have learned a practical rapid method of determining the proportions of metal in a silver and cadmium deposit; so that we can control accurately the proportion of each metal in the deposit. Also, we have had a rapid method for the determination of metal in a nickel bath. This requires but three standardized stock solutions and a medicine dropper. Lately we are working on chromium baths.

Mr. Ernest Alsfeld has been chromium plating jewelry successfully

DO NOT FORGET

July 8, 9, 10, 11, 1929

Annual Convention

American Electro-Platers' Society

Detroit, Mich.

Hotel Statler

on a large scale for nearly two years and attributes his success largely to the method of analysis and control that he is using.

Our genial assistant secretary has gone to the Indiana Tri-State College and is pursuing a course in Chemical Engineering. This is the real way to get there and we wish Brother Balkan a successful course.

John Andrews, Secy.

HARTFORD-CONNECTICUT VALLEY BRANCH

Hartford-Connecticut Valley Branch, A. E. S., held its March meeting at the Hartford Chamber of Commerce, at 805 Main St., Hartford, Conn., on Monday evening, March 25.

The meeting was called to order at 8:30 p. m., with President Elwin in the chair. Minutes of the previous meeting were read and accepted. All bills were voted paid; all correspondence was read. A resolution from the Detroit Branch was read and tabled for our next meeting. Chairman Kennedy reported names secured for office nomination for next term; these were as follows: President, Jos. E. Beloin; Vice-President, Edw. Fleming; Secretary, V. E. Grant; Librarian, T. Elwin. Board of Managers: F. J. Clark, H. R. MacFadyen, and D. W. MacDermid.

President Elwin then introduced Harold K. Work, Research Chemist, Mellon Institute of Industrial Research, Pittsburgh, Penn., who gave a very interesting talk on "Electro-plating on Aluminum and Its Alloys." Mr. Work handled the job in a very interesting and capable manner. His talk was the more interesting because of various samples and photographs which he exhibited. He answered many questions

asked in connection with his talk. In conclusion he was given a rising vote of thanks.

The meeting was attended by thirty-two members and visitors and was adjourned at 10:30 P. M.

V. E. Grant, Sec'y.

APPLICATIONS

	Branch
Alex Grzycowski, 1405 Jackson Blvd., Chicago, Ill.	Chicago
John C. Foley, 1500 Rose St., La Crosse, Wis.	Milwaukee
David Nirace, 718 42nd St., Milwaukee, Wis.	Milwaukee

ELECTIONS

	Branch
George Doersch, 222 Castle St., Baltimore, Md.	Baltimore-Washington
Frank Ruczko, 7642 S. 47th Ct., Chicero, Ill.	Chicago
Walter Covington, 609 Fulton St., Chicago, Ill.	Chicago
Edward Bauer, 1198 Long Ave., Hillside, N. J.	Newark
Harry J. Maurer, 81 Rich St., Irvington, N. J.	Newark
John Heine, 24 N. Short St., Troy, Ohio	Dayton
Fred R. Kilby, 649 Clifton Ave., Winnipeg, Manitoba, Can.	Toronto
Martin H. Reiker, Third St. and Pleasant Ave., Glenside, Pa.	Philadelphia

Associate

Lester M. Strunk, 32 Fairview St., Boyertown, Pa.	Philadelphia
Louis M. Hague, 1533 Valmont St., Pittsburgh, Pa.	Pittsburgh
Chas. Reuter, 27 N. 5th St., Newark, N. J.	Newark
Harold Smallman, 28 Middlesex St., Matawan, N. J.	Newark
Chas. C. Bauer, 2150 Quimby Ave., New York, N. Y.	New York

REINSTATEMENTS

	Branch
James Garvie, 5906 Colfax Ave., Detroit, Mich.	Detroit
Edward Gesser, 7915 E. Lafayette Ave., Detroit, Mich.	Detroit
Edward Ritter, 3741 Maxwell Ave., Detroit, Mich.	Detroit
Chas. C. Snyder, 628 Mulberry St., Toledo, Ohio.	Toledo
D. P. Ryan, 1944 Broadway, Toledo, Ohio.	Toledo
J. M. Cosgrove, 1121 16th St., Columbus, Ind.	Chicago

TRANSFERS

	Branch
John Stein.	From Toledo to Newark

SUSPENSIONS

	Branch
C. A. Burrows.	Indianapolis

BALTIMORE-WASHINGTON

Meets in Enoch Pratt Library, Calhoun and Hollins Sts. Geo. F. Turner, Secretary, Baltimore, Md.

BOSTON

Platers' Supply Co., 202 Friend St., Boston. Secretary, A. W. Garrett, 45 King St., Dorchester, Mass.

BRIDGEPORT

Meets first and third Friday of each month at 62 Cannon St., Room 17, Bridgeport, Conn. Secretary, Wm. Ehrencrona, 872 Hancock Ave., Bridgeport, Conn.

CHICAGO

Meets second Saturday of each month, at 8 p. m., Atlantic Hotel, 316 S. Clark St. Secretary, S. J. C. Trapp, 1127 N. 7th St., Maywood, Ill.

CINCINNATI

Meets every Thursday, 7:30 p. m., at Vocational Training School, Spring and Liberty St. Secretary, Al. Yeager, 2021 Sherman Ave., Norwood, Ohio.

CLEVELAND

Meets first Saturday of each month at Hotel Winton. H. Terdoest, 380 Pioneer Ave., Akron, Ohio.

HARTFORD-CONN. VALLEY

Meets fourth Monday in each month alternately at 266 Pearl St., Hartford, Conn., and corner Broadway and Worthington St., Springfield. Secretary, Vernon Grant, 43 Putnam St., Bristol, Conn.

DAYTON

Meets first Saturday of each month at the Y. M. C. A., Dayton, Ohio. Secretary, Robert G. Suman, 2734 Ridge Road, Dayton, Ohio.

DETROIT

Meets the first Friday of each month at the Hotel Statler, Louis II Room, Detroit. Secretary, Chas. Phillips, 13421 Camden Ave., Detroit, Mich.

GRAND RAPIDS

Meets on the second Saturday of each month at the Vocational High School, 129 Bostwick Ave., N. E. Secretary, Jacob Van Dyke, 1361 Union Ave., N. E., Grand Rapids, Mich.

INDIANAPOLIS

Meets the second Saturday of each month at Hotel Denison. Secretary, Louis Mertz, 1725 Union St., Indianapolis, Ind.

LOS ANGELES

Secretary, M. D. Rynkofs, 1354 W. 25th St., Los Angeles, Calif.

MILWAUKEE

Meets second and fourth Thursdays of each month at Cor. 3rd St. and Highland Ave. J. N. Hock, 1229 W. 24th St., Milwaukee, Wis.

MONTREAL

Meets last Friday of month at Office of Secretary, John H. Feelay, 411 Aylmer St., Montreal, Quebec, Canada.

NEWARK

Meets first and third Fridays of each month at Franklin Hall, 41 Franklin St., Newark, N. J., at 8 p. m. Secretary-Treasurer, Royal F. Clark, P. O. Box 201, Newark, N. J.

NEW YORK

Meets every second and fourth Fridays of each month in the World Building, Park Row, New York City, N. Y. Secretary, R. J. Liquori, 2439 Hubbard St., Brooklyn, N. Y.

PHILADELPHIA

Meets first Friday of each month in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Sts. Secretary, P. Uhl, 2432 North 29th St., Philadelphia, Pa.

PITTSBURGH

Meets first Friday of each month at 8 p. m., at downtown branch, Y. M. C. A. Secretary, S. E. Hedden, 227 Fifth St., Aspinwall, Pa.

PROVIDENCE-ATTLEBORO

Meets first and third Thursday of each month at 44 Washington St., Prov. Engineers Rooms, Providence, R. I. Secretary, J. H. Andrews, 19 Rosedale St., Providence, R. I.

ROCHESTER

Meets every third Friday of each month at the Powers Hotel. Secretary, Chas. Griffin, 24 Garson Ave., Rochester, N. Y.

ST. LOUIS

Meets second Friday of each month at Central Y. M. C. A., 16th and Locust St. Secretary, C. T. McGinley, 8214 Fairham Ave., University City, Mo.

TOLEDO

Meets first Thursday of each month at Toledo Secor Hotel, corner Cherry and Page Sts. Secretary, W. W. Welker, 2228 Middlesex Rd., Route 2, Box 635, Toledo, Ohio.

TORONTO

Meets fourth Monday of each month at Canadian Foresters' Hall, 22 College St., Room No. 2. Secretary, W. J. Sutherland, 197 Gillard Ave., Toronto, 6, Canada.

WATERBURY

Meets every second and fourth Thursday of each month. Secretary, Wm. F. Guilfoile, Garden Theatre Bldg., East Main St., Waterbury, Conn.

WORCESTER

Meets Directors' Room, Chamber of Commerce, Worcester, Mass. Roger H. Bryant, Secretary, 94 Grove St., Worcester, Mass.